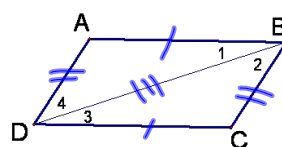
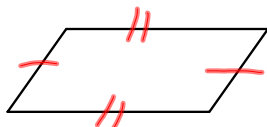


8.3 Show that a Quadrilateral is a Parallelogram

Theorem 8.7 If both pairs of opposite sides are congruent, then the quadrilateral is a parallelogram.



Given: $\overline{AB} \cong \overline{CD}$

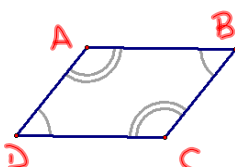
$\overline{AD} \cong \overline{BC}$

Prove: ABCD is a parallelogram

- ① ~
- ② $\overline{BD} \cong \overline{BD}$
- ③ $\triangle ABD \cong \triangle CDB$
- ④ $\angle 1 \cong \angle 3$; $\angle 4 \cong \angle 2$
- ⑤ $\overline{AB} \parallel \overline{DC}$; $\overline{AD} \parallel \overline{BC}$
- ⑥ ABCD is a \square

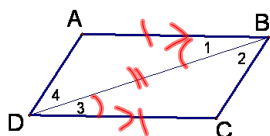
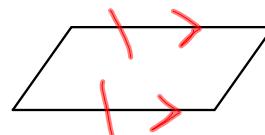
- ① Given
- ② Reflexive
- ③ SSS
- ④ CPCTC
- ⑤ Alt Int \angle s Converse
- ⑥ def of \square

Theorem 8.8 If both pairs of opposite angles are congruent, then the quadrilateral is a parallelogram.



Proof plan?

Theorem 8.9 If one pair of opposite sides is both congruent and parallel, then the quadrilateral is a parallelogram.



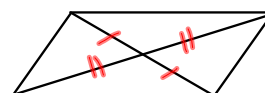
Given: $\overline{AB} \cong \overline{DC}$ $\overline{AB} \parallel \overline{DC}$

Prove: ABCD is \square

- ① ~
- ② $\angle 1 \cong \angle 3$
- ③ $\overline{BD} \cong \overline{BD}$
- ④ $\triangle ABD \cong \triangle CDB$
- ⑤ $\angle 4 \cong \angle 2$
- ⑥ $\overline{AD} \parallel \overline{BC}$
- ⑦ ABCD is \square

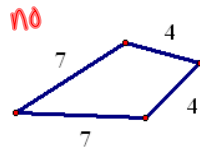
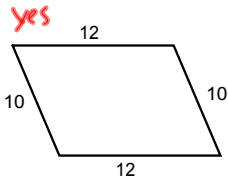
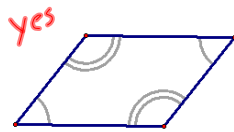
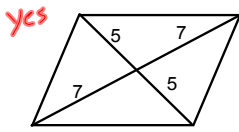
- ① Given
- ② Alt Int \angle s then
- ③ Reflexive
- ④ SAS
- ⑤ CPCTC
- ⑥ Alt Int \angle s conv.
- ⑦ def of \square

Theorem 8.10 If the diagonals bisect each other, then the quadrilateral is a parallelogram.



Proof plan?

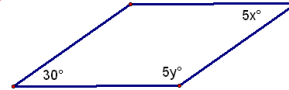
Are the following parallelograms? Why?



Find x and y so that the quad. is a parallelogram.

$$5x = 30$$

$$x = 6$$



$$5y + 30 = 180$$

$$5y = 150$$

$$y = 30$$

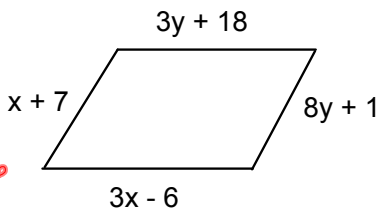
Find x and y so that the quad. is a parallelogram.

$$x + 7 = 8y + 1$$

$$3y + 18 = 3x - 6$$

$$y = 2$$

$$x = 10$$



Parallelograms on the coordinate plane.

- distance, midpoint, and slope can be used to determine if a quadrilateral is a parallelogram

Determine whether a figure with the given vertices is a parallelogram. Use the indicated method.



A(0, 0) B(1, 3) C(5, 3) D(4, 0)

Slope formula

$$\overline{AB} \ m = \frac{3-0}{1-0} = 3$$

$$\overline{CD} \ m = \frac{3-0}{5-4} = 3$$

$$\overline{AD} \ m = \frac{0-0}{4-0} = 0$$

$$\overline{BC} \ m = \frac{3-3}{5-1} = 0$$

$\overline{AB} \parallel \overline{CD}$ $\overline{AD} \parallel \overline{BC} \therefore ABCD$ is \square

Determine whether a figure with the given vertices is a parallelogram. Use the indicated method.

A(-1, 0) B(3, 0) C(2, -3) D(-3, -2)

Distance formula

$$AB = \sqrt{4^2 + 0^2} = 4$$

$$CD = \sqrt{5^2 + (-1)^2} = \sqrt{26}$$

Not a \square

Determine whether a figure with the given vertices is a parallelogram. Use the indicated method.

A(-2, 4) B(-1, -1) C(3, -4) D(2, 1)

Midpoint formula

check diag.

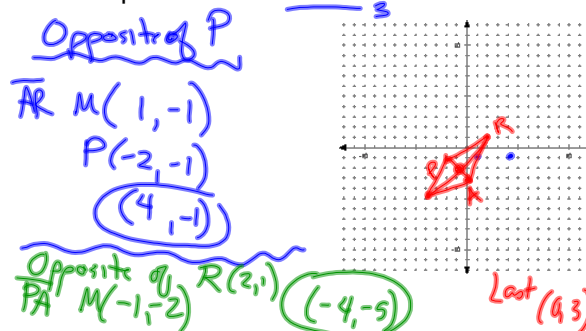
$$\overline{AC} \left(\frac{-2+3}{2}, \frac{4+(-4)}{2} \right) \left(\frac{1}{2}, 0 \right)$$

$$\overline{BD} \left(\frac{-1+2}{2}, \frac{-1+1}{2} \right) \left(\frac{1}{2}, 0 \right)$$

ABCD is a \square b/c diagonals bisect each other

A parallelogram has the vertices P(-2, -1) R(2, 1) and A(0, -3).

Find all possible coordinates of the 4th vertex.



HW

p526-529

4-6, 11-14, 19-21, 25, 26, 38, 39